THE DESIGN OF OPEN-HEARTH FURNACES

Design computations for an open-hearth furnace do not require any large amount of mathematical knowledge, for the principles involved are comparatively simple. As in all other engineering and chemical propositions, it is necessary to effect a compromise between a number of different requirements and co-ordinate them in the right manner to secure a desired result. All of the different elements of the problem are closely interrelated, and changes and modifications at one point necessitate carrying a corresponding modification through the entire system which it affects.

In order to establish a point of departure, it has been assumed that a furnace having a nominal capacity of 100 tons is to be designed, that it is to be fired with producer gas, and that the actual hearth area will be 650 sq ft. The computations will be limited to those required to establish the design lines. Certain factors may bp more or less arbitrarily fixed without regard to current practice or whether they are desirable or not, merely for the purpose of furnishing a working base, the purpose of the computation being to illustrate the formulas used and their application.

The reactions in the open hearth are well known. Their main effect, as far as the flue gases are concerned, is an increase in C02 and in the moisture content, the latter in the first part of the heat, and the former during the boil and after the limestone is added. The fuel consumption will vary with the furnace, the method of working, etc. Ranging from 220 kg (485 Ib) per ton, using molten pig, up to 350 kg (770 Ib) per ton and higher. The fuel consumption is not uniform during each furnace cycle, from charge to charge, but varies about as follows:

Percentage of . Cycle	Percentage of Fuel Consumed
63.00	76.00
17.00	15.20
14.00	8.40
1.00	0.40
5.00	
100.00	100,00